REMARKS

Claims 15 and 16, 18 - 20 and 24 - 29 are in this application and are presented for consideration. Claims 15, 18 - 20, 24 and 26 - 28 have been amended and new claim 29 has been added.

The specification, abstract and claims have been amended to address the Examiner's rejections, incorporate the Examiner's suggestions, and to place the application in better form. Applicant thanks the Examiner for providing suggestions. If the Examiner desires any additional changes to this application, Applicant respectfully requests that the Examiner indicate which portions of the application should be revised.

The paragraphs on page 7 have been revised to clarify the present invention with regard to claim 15. In particular the specification more clearly distinguishes between the lower boiling SiH_4 - containing product and the higher boiling $SiCl_4$ containing product as well as between the lower boiling components and the higher boiling components of the lower boiling SiH_4 containing product.

The claims have been rejected as being obvious over YAMADA with or without BAKAY.

With this Amendment Applicant has added new claim 29 which is a process step and sets forth the step of cooling the SiH_4 containing product with temperatures in the range of -5°C to 40°C. Support for this can be found in the specification on page 7 line 15, page 8 line 11 and page 11 lines 15 - 19. Page 11 in particular sets forth that one embodiment of the present invention performs the cooling with a coolant having a temperature of 25°C. Applicant

has found this temperature range to be very beneficial, especially for efficiencies in heating and cooling of the entire process.

Applicant has reviewed YAMADA, and finds no teaching nor suggestion of a cooling step in the range of -5°C to 40°C. Therefore YAMADA cannot anticipate all the features of new claim 29. The rejection states that YAMADA describes a -10°C temperature at column 15 lines 15 - 17. However this temperature range is not within the temperature range of claim 29. Therefore this portion does not anticipate the temperature range of claim 29.

Claim 29 also sets forth providing a rectifying section. Applicant finds no teaching nor suggestion of a rectifying section in YAMADA.

Support for this rectifying section can be found in the present drawings as indicated by reference 7, and in the specification on page 8. Claim 29 in particular sets forth that the product which is not condensed during the cooling step is introduced into the rectifying section. Applicant finds no teaching nor suggestion of YAMADA introducing any product after a cooling step into a rectifying section. Since YAMADA does not describe a rectifying section, YAMADA clearly cannot describe introducing a product after a cooling step into a rectifying section. Therefore YAMADA does not anticipate the rectifying section and the steps in claim 29 that use a rectifying section. Claim 29 therefore further defines over YAMADA.

Applicant further finds no suggestion or motivation in YAMADA to provide a rectifying section, and to especially introduce product after a cooling step into a rectifying section. It is only the present invention which introduces a product into a rectifying section after a cooling step. Since there is no suggestion or motivation to modify YAMADA to have a rectifying

section, and to introduce product into the rectifying section after cooling step, YAMADA cannot cause claim 29 to be obvious.

The reference of BAKAY has been used to describe the temperatures of -24°C and -21°C. Applicant notes that these temperature ranges are outside the temperature ranges of new claim 29. Therefore this portion of BAKAY does not anticipate the temperature ranges of new claim 29.

Applicant has reviewed BAKAY, and notes that the carbon trap is arranged at the outlet of a condenser, column 6 lines 34 - 37. This portion of BAKAY also seems to indicate that the carbon trap is at room temperature. The table in column 7 of BAKAY indicates a carbon trap temperature which is below room temperature. Therefore it does not appear that the carbon trap is performing active cooling.

Applicant further finds no teaching nor suggestion of a rectifying section in BAKAY, and especially no teaching nor suggestion of introducing a product from the cooling step into a rectifying section. Therefore the combination of YAMADA and BAKAY also fails to anticipate all of the features of claim 29. Claim 29 therefore cannot be considered obvious in view of YAMADA and BAKAY.

Applicant has found that cooling in the temperature range of -5°C to 40°C, and performing this cooling prior to the introduction into the rectifying section, is very advantageous, especially from a heat efficiency point of view. The specification indicates in several portions, that the temperature range of -5°C to 40°C is the preferred temperature range for optimum efficiency. Applicant has reviewed the prior art, and finds no teaching nor

suggestion of adjusting temperatures, especially in an intermediate condenser and before a rectifying section for optimum heat efficiency. It is only the present invention which has discovered this particular temperature range and its benefit of heating efficiency. The present invention is therefore an improvement over the prior art, and Applicant respectfully requests patent protection for this improvement.

Claims 15 and 20 have also been amended to set forth the temperature range of -5°C to 40°C, and the introduction of the products from the cooling into a rectifying section. As described above, the prior art does not teach nor describe such features, and therefore these claims also define over the prior art.

YAMADA et al. indicates no advantage concerning the energy consumption of the process that corresponds directly with this special operation temperature of the cooling or intermediate condenser of the present invention. In column 14, lines 1 to 2 YAMADA et al. discloses an operation temperature –60°C. Thus, YAMADA et al. has not recognized the special advantage concerning the reduction of the energy consumption due to an operation temperature of an intermediate condenser in the range of –5°C to 40°C.

The objective disclosed in YAMADA et al. is to provide an integral process using a continuous production method for silane which is excellent in the rate of disproportionation reaction and which re-uses the by-product $SiCl_4$ (column 3, lines 48 to 54).

In contrast to YAMADA et al., the present invention discloses an operation temperature of the intermediate condenser (6) in the range of –5°C to 40°C. The condensation of higher-boiling components in the lower-boiling SiH_4-containing product in the intermediate condenser

(6) avoids removing a large amount of heat at the condensation temperature of silane that is at –50°C to –120°C. For example it is possible to remove 60% to 97% of the condensation heat of the overall process by the use of an intermediate condenser operated at a temperature of 25°C. By the removal of condensation heat at an operation temperature of the intermediate condenser in the range of –5°C to 40°C the energy costs can be decreased enormously. This advantage has been recognized and used in the invention for the first time.

Furthermore, in the present invention the rectifying section (7) located between the intermediate condenser (6) and the overhead condenser (9) increases the SiH_4-concentration of the lower-boiling SiH_4-containing product. By increasing the SiH_4-concentration the amount of the remaining SiH_4-containing product to be condensed in the overhead condenser (9) can be further decreased. Consequently, the energy consumption due to a condensation heat removal at low temperature can be further reduced.

Furthermore, the arrangement of the rectifying section between the intermediate condenser and the overhead condenser enables in combination with the distillative stripping section (4) that the energy introduced is used several times, firstly for purifying and concentrating the silane in the rectifying section (7), secondly for increasing the reaction rate in the reactive/distillative reaction zone (2) and thirdly for purifying the $SiCl_4$ in the lower part of the reaction column.

An intermediate condenser operated at a temperature in the range of –5°C to 40°C in combination with a rectifying section arranged between the intermediate condenser and the overhead condenser for increasing the SiH_4-concentration in order to reduce the energy

consumption of the overall process is not disclosed in YAMADA et al. and is not obvious as well.

BAKAY (US 3,968,199) and the DE 25 07 864 are members of the same patent family. The disadvantages of the process for manufacturing silane disclosed in BAKAY (= DE 25 07 864) have been discussed in detail on pages 2 to 5 of the patent application.

BAKAY does not disclose an intermediate condenser operated at a temperature in the range of –5°C to 40°C and a rectifying section arranged between the intermediate condenser and the overhead condenser for increasing the SiH_4-concentration in the lower-boiling SiH_4-containing product. BAKAY gives an ordinary skilled person no idea of operating the intermediate condenser disclosed in YAMADA et al. at a temperature in the range of –5°C to 40°C and of arranging a rectifying section between the intermediate condenser and the overhead condenser for increasing the SiH_4-concentration of the lower-boiling SiH_4-containing product. Consequently amended claims 15, 20 and new claim 29 are non-obvious over YAMADA et al. in view of BAKAY.

If the Examiner has any comments or suggestions which would further favorable prosecution of this application, the Examiner is invited to contact Applicant's representative by telephone to discuss possible changes.

At this time Applicant respectfully requests reconsideration of this application, and based on the above amendments and remarks, respectfully solicits allowance of this application.

Respectfully submitted
for Applicant,

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